Claims

[c1]   1.A flash-card reader and exchanger comprising:

a first serial-bus connector for receiving a serial cable connected to a host computer that acts as a serial-bus host;

a second serial-bus connector for receiving a serial-bus flash-memory drive;

a serial bus connected to the first and second serial-bus connectors;

an input-output bus;

a dual-mode microcontroller coupled to the serial bus and coupled to the input-output bus, for operating in a card-reader mode and responding as a serial-bus peripheral to requests from the host computer when the host computer is connected, but for operating in an exchanger mode and originating data transfers as a local host of the serial bus when the host computer is not connected to the first serial-bus connector;

a flash-card interface for receiving a removable flash-memory card, the flash-card interface connected to the input-output bus; and

an exchanger program, executed by the dual-mode microcontroller, for reading data from the removable flash-

memory card over the input-output bus to the dual-mode microcontroller, and for writing data over the serial bus to the serial-bus flash-memory drive, when the dual-mode microcontroller is operating in the exchanger mode,

whereby the flash-card reader and exchanger operates in the card-reader mode when the host computer is connected, but operates in the exchanger mode, originating data transfers as a local host, when the host computer is not connected.

[c2]   2.The flash-card reader and exchanger of claim 1 wherein the serial bus is a PCI Express bus, an Express-Card bus, a Firewire (IEEE 1394) bus, a serial ATA bus, or a serial attached small-computer system interface (SCSI) bus.

[c3]   3.The flash-card reader and exchanger of claim 1 wherein the serial bus is a Universal-Serial-Bus (USB).

[c4]   4.The flash-card reader and exchanger of claim 3 wherein the dual-mode microcontroller is a USB On-the-Go controller or a USB reduced-function host controller acting as a USB host when not connected to the host computer, but acting as a USB peripheral when connected to the host computer.

[c5] 5.The flash-card reader and exchanger of claim 3 wherein the dual-mode microcontroller comprises:

a serial interface to a serial bus that connects to a host;

a serial engine for detecting and processing packets sent over the serial bus;

a serial-engine buffer for storing data sent over the serial bus;

an internal bus coupled to the serial-engine buffer;

a random-access memory (RAM) for storing instructions for execution, the RAM on the internal bus;

a central processing unit, on the internal bus, the CPU accessing and executing instructions in the RAM; and

an input-output controller, on the internal bus, for communicating with the input-output bus.

[c6] 6.The flash-card reader and exchanger of claim 5 further comprising:

an indicator lamp for indicating when data is being transferred by the dual-mode microcontroller; and

a user-activated button for initiating data transfer, wherein the indicator lamp and the user-activated button are connected to the input-output bus.

[c7] 7.The flash-card reader and exchanger of claim 6 wherein the indicator lamp comprises:

a first direction lamp that indicates when the removable flash-memory card is to be read;

a second direction lamp that indicates when the removable flash-memory card is to be written;

a card-reader mode lamp that indicates when the dual-mode microcontroller is operating in the card-reader mode; and

an exchanger mode lamp that indicates when the dual-mode microcontroller is operating in the exchanger mode.

[c8]   8.The flash-card reader and exchanger of claim 7 wherein the indicator lamp comprises at least one multi-color light-emitting diode (LED).

[c9]   9.The flash-card reader and exchanger of claim 7 further comprising:

a card insertion lamp that indicates when the removable flash-memory card has been properly inserted into the flash-card interface.

[c10]   10.The flash-card reader and exchanger of claim 6 wherein the removable flash-memory card is a compact-flash card, a smart-media flash-card, a secure-digital/multi-media card, or a memory stick.

[c11]   11.The flash-card reader and exchanger of claim 10 further comprising:

a flash-integrated memory module, coupled to the in-

put-output bus; and

a liquid crystal display (LCD), coupled to the input-output bus.

[c12] 12.The flash-card reader and exchanger of claim 6 wherein the exchanger program further comprises:

a main control program that waits for insertion of the removable flash-memory card and activates the exchanger mode when the host computer is not connected to the serial bus, but activates the card-reader mode when the host computer is not connected to the serial bus.

[c13] 13.The flash-card reader and exchanger of claim 12 further comprising:

a flash-exchanger program, activated by the main control program when operating in the exchanger mode, the flash-exchanger program causing the dual-mode microcontroller to read data from the removable flash-memory card over the input-output bus, the flash-exchanger program causing the dual-mode microcontroller to send data to the serial-bus flash-memory drive as serial-bus packets;

wherein the flash-exchanger program means includes means for reading a disk format of data, the disk format being File-Allocation Table (FAT), FAT32, New Technology File System (NTFS), Second Extended File System (Ext2), Third Extended File System (Ext3), Hierarchical

File System (HFS), and Universal File System (UFS).

[c14]   14.A user-expandable flash-card exchanger comprising:

a local Universal-Serial-Bus (USB) segment;

a host USB connector for connecting the local USB segment to a host computer that executes a USB host program to originate USB transfers;

a second USB connector for receiving a USB-memory key drive, the USB-memory key drive having a flash memory for storing data from USB packets sent over the local USB segment;

a USB dual-mode microcontroller, having a serial engine connected to the local USB segment, for executing a USB peripheral-mode program to respond to USB requests from the host computer during a peripheral mode, and for executing a local-host program to initiate data transfers when the host computer is not connected;

an input-output bus, driven by the USB dual-mode microcontroller, for transferring data, addresses, and commands;

a flash-card connector, coupled to the input-output bus, for receiving a removable flash-memory card;

wherein the USB dual-mode microcontroller reads data from the removable flash-memory card over the input-output bus by sending flash-memory commands to the removable flash-memory card;

an indicator on the input-output bus, for indicating operating status to a user; and

a user-input device on the input-output bus, for receiving an input from the user,

whereby the USB dual-mode microcontroller operates as a USB peripheral when the host computer is attached, but executes the local-host program when the host computer is not connected.

[c15]   15.The user-expandable flash-card exchanger of claim 14 wherein the removable flash-memory card is a compact-flash card, a smart-media flash-card, a secure-digital/multi-media card, or a memory stick.

[c16]   16.The user-expandable flash-card exchanger of claim 15 further comprising:

a second flash-card connector, for receiving a second type of removable flash-memory card that is a different type of removable flash-memory card that received by the flash-card connector,

whereby at least two different types of the removable flash-memory card can be read.

[c17]   17.The user-expandable flash-card exchanger of claim 14 wherein the USB dual-mode microcontroller comprises:

an internal bus;

a central processing unit, coupled to the internal bus, for executing instructions;

a local program memory for storing program code executed by the central processing unit including the USB peripheral-mode program and the local-host program;

an input-output controller, coupled to the internal bus and to the input-output bus; and

wherein the serial engine comprises a serial interface to the local USB segment, and a serial-engine buffer, coupled to the internal bus, for storing data sent over the local USB segment.

[c18]   18.A flash-card exchanger comprising:

dual-mode microcontroller means for executing control programs;

a Universal-Serial-Bus (USB) connected to the dual-mode microcontroller means;

first connector means, coupled to the USB, for receiving a USB-memory key drive that stores data contained in USB packets in response to USB requests;

second connector means, coupled to the USB, for connecting to an external USB host that originates USB requests to the dual-mode microcontroller means;

input-output bus means, controlled by the dual-mode microcontroller means;

first flash interface means, connected to the input-out-

put bus means, for interfacing to a removable flash-memory card;

indicator means, connected to the input-output bus means, for indicating a status to a user in response to the dual-mode microcontroller means;

activating-input means, connected to the input-output bus means, for receiving an input from the user, the activating-input means sending a user-activating signal to the dual-mode microcontroller means;

main control program means, executed by the dual-mode microcontroller means, for detecting insertion of the removable flash-memory card, for detecting connection of the USB-memory key drive to the first connector means, and for detecting connection of the external USB host to the second connector means, for activating a USB peripheral mode when the external USB host is connected, but for activating a local-host mode when the external USB host is not connected, but the USB-memory key drive is connected, the main control program means causing the indicator means to display a mode status indicating the USB peripheral mode or the local-host mode;

wherein the external USB host reads data from the removable flash-memory card through the dual-mode microcontroller means when operating in the USB peripheral mode; and

flash-exchanger program means, executed by the dual-mode microcontroller means when operating in the local-host mode and the user-activating signal is received from the activating-input means, for blinking the indicator means and transferring data between the removable flash-memory card and the USB-memory key drive without an external USB host,

whereby the flash-exchanger program means operates when the external USB host is not connected.

[c19]   19.The flash-card exchanger of claim 18 further comprising:

second flash interface means, connected to the input-output bus means, for interfacing to a second type of removable flash-memory card.

[c20]   20.The flash-card exchanger of claim 18 wherein the indicator means comprises:

a first light-emitting diode (LED) that is lit when the removable flash-memory card is inserted into the first flash interface means;

a second LED that is lit when the USB-memory key drive is connected to the first connector means and the external USB host is not connected to the second connector means;

a third LED that is lit when the external USB host is connected to the second connector means; and

a direction LED that is lit to indicate a direction of data transfer.